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10/566,476	01/31/2006	Kazuhiro Murata	0234-0507PUS1	5098

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EXAMINER	
SULTANA, NAHIDA	

ART UNIT	PAPER NUMBER
1791	

NOTIFICATION DATE	DELIVERY MODE
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

mailroom@bskb.com

Office Action Summary	Application No.	Applicant(s)	
	10/566,476	MURATA ET AL.	
	Examiner	**Art Unit**	
	NAHIDA SULTANA	1791	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *11 June 2010*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1,3-24,35 and 36* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1,3-24,35 and 36* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *09 October 2009* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

1. **<u>This First action</u>** is in response to the amendment received on 06/11/2010, as a request for continuation of examination.

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

3. Claims 1, 3-6, 8-16, 23-24, and 35 are rejected under 35 U.S. C. 103(a) as being unpatentable over Danforth et al. (US patent No. 5, 997, 795) in view of Sachs et al. (US Patent No. 5, 807, 437) and in further view of Gratson (US Publication 2006/0235105 A1).

For claims 1, 3 and 35, Danforth et al. teach:

A method of producing a three-dimensional structure (abstract), comprising the steps of: providing a nozzle having interchangeable size and shape of the dispensing head outlet using various orifice sizes and shapes, or interchangeable orifice inserts in the tip of the nozzle (col. 10. lines 30-40; col. 25. lines 35-65); arranging a substrate close to a tip of fluid-ejection body (example Fig. 3. Items 14 (“print head"), 19 ("substrate")), having a desired diameter (“nozzle sizes” col. 10. lines 30-40), supplied with a solution (“material” Col. 6. lines 15-40); ejecting a fluid having smaller diameter toward a surface of the substrate (col. 6. lines 60-65), making the fluid land on the

substrate (example fig. 3, Item 100); and solidifying the droplet after the fluid droplet is landed on the substrate (Col. 11. lines 40-60), and droplets/material are deposited layer by layer to form the three-dimensional structure (col. 11. lines 30-60, col. 25. lines 45-65). Danforth et al. also discloses material/droplet solidified after landing on the substrate (col. 11. lines 30-65).

However, Danforth et al. do not teach: **nozzle having inside diameter between 0.01 micrometer to 8 micron** and **applying a voltage having a prescribed waveform to the needle-shaped fluid-ejection body; wherein the electric line of force is attracted to top of solidified substance of the droplet, and where needle shaped body is a microcapillary tube.**

In the same field of endeavor, three dimensional printing system, Sachs et al. teach: ejecting a fluid droplet having an **ultra-fine diameter** from the tip of the nozzle toward a surface of the substrate (col. 4. lines 50-55), **applying a voltage** having a prescribed waveform to the needle-shaped fluid-ejection body ("voltage applied to charging cells" Col. 4. lines 10-25), forming three dimensional printing pattern (example Fig. 1 & 2, col. 3. lines 25-40), wherein the electric line of force is attracted to top of solidified substance of the droplet (col. 4. lines 40-50), and wherein the three dimensional structure is grown by stacking the subsequent flying droplet guided along electric line of force onto the top of the solidified substance (abstract; col. 4. lines 33-45); wherein the needle-shaped nozzle is a micro-capillary tube (col. 4. lines 60-65).

Sach et al. also teaches diameter of the nozzle **is less than 50 micron (col. 5. lines 15-25).** Examiner notes that depending on particular application, using a specific nozzle size would have been obvious to one ordinary skill in the art to form a three dimensional structure.

It would have been obvious to one ordinary skill in the art at the time of the applicant's invention to modify the process of making three dimensional structure as taught in Danforth et al. with having electrostatic charge applied to the fluid, as taught in Sachs et al., for the benefit of controlling the landing position of the droplet at a target position (Col. 4. lines 40-50).

However, **Sach et al. do not specifically teach wherein the nozzle inside diameter is 0.01 micron to 8 micron.**

For example, In the same field of endeavor, **directed to forming three-dimensional structures at micron-scale features, Gratson et al. discloses forming three dimensional structure by layer-wise (paragraph [0014]) having nozzle size less than 10 micron (paragraph [0013]) and specifically nozzle diameter size at most 1 micron (see claim 47).**

It would have been obvious to one ordinary skill in the art at the time of the applicant's invention to modify above, with further having specific micro scale nozzle size as taught in Gratson et al., for the **benefit of producing three-dimensional structure with micron-scale features (paragraph [0001-0002]).**

For claim 4, Danforth et al. further teach having similar material and solvent: (“particular material may be selected from the group consisting of ceramic materials, elemental metals, metal alloys…” col. 6. Lines 25-40, Col. 8. lines 20-35, “size of the largest particles in the distribution should be substantially smaller than the diameter of the dispensing nozzle” col. 6. lines 60-65), and the three-dimensional structure is controlled by a volatile property of the droplet ejected from the needle-shaped fluid-ejection body (“material” col. 6. lines 25-40; “material dispersed is adheres to the previous layer” col. 12. lines 25-30).

For claim 5, Danforth et al. teach wherein a temperature of the substrate is controlled in that the previously landed droplet on the substrate is volatilized to be hard enough for the subsequent droplet stacked thereon (col. 10. lines 50-60, col. 11, lines 30-65, col 25. lines 45-65).

Claim 6, Danforth et al. further teach: wherein a surface temperature of the substrate is controlled by at least one heating means selected from the group consisting of a Peltier element, an electric heater, an infrared heater, a heater using fluid such as an oil heater, a silicon rubber heater, and a thermistor, that is fixed to the substrate or a substrate supporting body (“voltage current applied to heat substrate” Col. 10. lines 55-60).

Regarding Claim 8, 9, 10, and 11, Danforth et al. further teach: wherein the fluid is a solution containing metal particulates (Col 6. lines 25-40), wherein the fluid is a polymer solution (Col. 7. lines 35-50, col. 8. lines 20-35), wherein the fluid is a solution containing ultra-fine ceramic particles (“ceramic” and “size of particles” col. 6, lines 25-

40 & 60-67), fluid is sol-gel of ceramic ("ceramic" Col. 6. lines 25-40 & 60-67).

For claims 12-13, Danforth et al. further teach: wherein the fluid is a fluid containing at least one solution selected from the group consisting of a solution containing metal particulates, a polymer solution, a solution containing ultra-fine ceramic particles, a sol-gel solution of ceramics, and a low-molecular weight compound solution (Col. 6. lines 25-40).

As for claim 14-16, as disclosed above, Danforth mentioned that nozzle size and shape depends on a particular application (col. 10. lines 25-40). Danforth do not specifically teach wherein a diameter of ejected droplet is 15 micron or less, or 5 micron or less, or 3 micron or less. For example, In the same field of endeavor, **directed to forming three-dimensional structures at micron-scale features, Gratson et al. discloses forming three dimensional structure by layer-wise (paragraph [0014]) having nozzle size less than 10 micron (paragraph [0013]) and specifically nozzle diameter size at most 1 micron (see claim 47), and therefore, it is inherent that size of the droplet are within the claimed range.**

For claims 23-24, Danforth et al. further teach: wherein the dielectric constant of the fluid to be ejected is 1 or more ("low dielectric material" Col. 2. lines 1-5), and wherein the steps are conducted in an atmosphere having a vapor pressure of the fluid lower than a saturated vapor pressure of the fluid ("holes may be filled with air or vacuum" col. 1. lines 60-67).

4. Claims 7, and 14-22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Danforth et al. (US Patent No. 5, 997, 795) in view of Sachs et al. (US Patent No. 5, 807, 437), in view of Gratson (US Patent 2006/0235105 A1), and in further view of Hayes (US Patent No. 6, 114, 187).

For claim 7, Danforth et al. teach: producing a three dimensional structure, arranging a substrate close to a tip of ejection body (example Fig. 3. Items 14 ("print head"), 19 ("substrate")), however failed to teach: **wherein a surface temperature of the substrate is control in a range from room temperature to 100 ^{o}C**.

In the same field of endeavor, method for preparing a chip scale package and product produced by the method, Hayes teaches: wherein a surface temperature of the substrate is controlled in a range of from room temperature to 100 ^{o}C (col. 10. lines 10-30).

It would have been obvious to one ordinary skill in the art at the time of the applicant's invention to modify the method of producing three dimensional structure as taught by Danforth et al. Sachs et al. with having to control substrate temperature at a specific range, as taught in Hayes, for the benefit of solidifying the droplet faster, since substrate temperature affect the freezing of the droplet (col. 10. lines 10-25).

Regarding claims 14-16, Danforth et al. teach distribution of the droplet substantially smaller than the diameter of the dispensing nozzles outlet as to avoid any bridging effect (col. 6. lines 60-65) and nozzle size shape depends on the application of product being made (col. 10. lines 30-40), however fail to teach specifically: wherein a

diameter of the ejected droplet is 15 micrometer or less, wherein a diameter of the droplet is 5 micrometer less, wherein a diameter of the droplet is 3 micrometer or less.

In the same field of endeavor, method for preparing a chip scale package and product produced by the method, Hayes teaches: wherein a diameter of ejected droplet is 15 micrometer or less (col. 8. lines 15-25), wherein a diameter of the droplet is 5 micrometer or less (col. 8. lines 15-25), and wherein a diameter of the droplet is 3 micrometer or less (col. 8. lines 15-25).

It would have been obvious to one ordinary skill in the art at the time of the applicant's invention to modify the diameter of the droplet as taught by Danforth et al. with having specific diameter of the droplet, as shown in Hayes for the benefit of having device filled via cone shaped solder column 28 in which the vias act as mold to define the column (col. 8. lines 15-25), and specific use in integrated circuit chip (col. 8. lines 24-27).

For claims 17, 18, and 19, Danforth et al. teach: deposited layer solidify rapidly (col. 12. lubes 40-55). However, Danforth et al. fail to teach specifically: wherein a time required for the droplet to be dried and solidified is 2 seconds or less; wherein the time required for the droplet to be dried and solidified is 1 second or less; wherein the time required for the droplet to be dried and solidified is 0.1 second or less.

In the same field of endeavor, Hayes et al. teach: heating substrate using to about 75 ^{o}C (Col. 5. lines 50-55), for the benefit of freezing the metal alloy which is typically at 220 ^{o}C (col. 5. lines 50-55).

It would have been obvious to one having the ordinary skill in the art at the time

of the invention to optimize the substrate temperature, and jetting material temperature as taught in Hayes et al. for the benefit solidifying the droplet at specific amount of time, since it has been held that discovering the optimum value of a result effective variable involves only routine skill in the art. *In re Boesch, 617 F.2d 272, 205 USPQ 215 (CCPA 1980).*

Regarding claims 20, 21, 22, Danforth et al. fail to teach: wherein a flying speed of the droplet is 4 m/sec or more; wherein the flying speed is 6 m/sec or more; wherein the flying speed is 10 m/sec of more.

In the same field of endeavor, method for preparing a chip scale package and product produced by the method, Hayes teaches: wherein a flying speed of the droplet is 3 m/sec (col. 10. lines 25-30), and teaches speed of the jetting device is varied with the applied voltage applied to the print-head (col. 5. lines 25-30).

However, Danforth et al. do not teach having flying speed at 4m/sec or more, or 6 m/sec of more.

It would have been obvious to one having the ordinary skill in the art at the time of the invention to optimize the voltage applied to the print-head (col. 5. lines 25-30) in Hayes for the benefit of getting specific speed of the droplet, since it has been held that discovering the optimum value of a result effective variable involves only routine skill in the art. *In re Boesch, 617 F.2d 272, 205 USPQ 215 (CCPA 1980).*

5. Claim 36 is rejected under 35 U.S. C. 103(a) as being unpatentable over Danforth et al. (US patent No. 5, 997, 795) in view of Sachs et al. (US Patent No. 5, 807, 437) and in further view of Gratson (US Publication 2006/0235105 A1), and in further view either **any one of <u>Uchiyama et al. (US patent 4,897, 667) or Hertz (US Patent 3, 916, 421).</u>**

As for claim 36, Danforth, Sachs et al., Gratson disclosed all the limitation as mentioned above, however failed to explicitly teach comprising an electrode within the nozzle.

For example, in the same field of endeavor, ink jet printer in which ink is continuously sprouted through a nozzle and divided into ink droplet, Uchiyama et al. teach further comprising an electrode within the nozzle (col. 4. lines 20-25), for the benefit of controlling the landing of the droplet.

Also, for example, in the same field of endeavor, ink jet printing, Hertz disclose a nozzle having electrode within the nozzle (as shown in 3, item 9, 2) for the benefit of charging droplets out of the nozzle (col. 2. lines 50-65).

It would have been obvious to one ordinary skill in the art at the time of the applicant's invention to modify above, with further having an electrode within the nozzle, as taught by Uchiyama, or Hertz for the same benefit as mentioned above.

Response to Arguments

6. Applicant's arguments with respect to claims 1, 3-24, 35-36 have been considered but are moot in view of the new ground(s) of rejection.

7. Applicant amended claim 1, to incorporate limitation of inner nozzle diameter size, and after further consideration, the claim as amended render obvious over prior art Danforth, Sachs et al., Gratson, and either any one of Uchiyama, Hertz.

8. In regards to claim 36, applicant argued that Uchiyama's nozzle head has inner electrode 27 and outer electrodes 30, 31, 32. However, these electrodes do not work for ejecting the liquid stream, but rather control the route of the stream.

9. Examiner's response: Applicant did not claim that electrode is pushing/ejecting liquid stream out of the nozzle. The way claim reads, Uchiyama reference broadly reads on the claim, that electrode is within the nozzle as disclosed above in claim 36.

Conclusion

10. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure:

11. US Publications # 2004/0251581 A1; 2007/0029698 a1; 2007/0029693 A1; 2005/0275129 A1; 2006/0262163 A1.

12. Any inquiry concerning this communication or earlier communications from the examiner should be directed to NAHIDA SULTANA whose telephone number is (571)270-1925. The examiner can normally be reached on Mon- Fri 9:30 Am - 6:00 PM EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Joseph Del Sole can be reached on 571-272-1130. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

NS

/Maria Veronica D Ewald/
Primary Examiner, Art Unit 1791